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SOCIETY OF ARTS.

FRIDAY, NOVEMBER 11th, 1853.

As the Session commences on Wednesday next, the present is thought the fitting period for closing the first volume of the *JOURNAL*, so that the new one may begin with the opening of the Session. With this Number a Title-page and Index is given, and Mr. Sopwith's valuable paper is concluded, instead of carrying it on to the next Volume. It is true that there will be but fifty-one numbers, but to have carried it on to a fifty-second number to make the year complete, would have involved the necessity of recording the opening proceedings of the coming Session in one volume, with the remainder of the Session in the next. It has been thought that it would be a more convenient arrangement to make each volume a complete record of each Session. The Members have now had one year's trial of the *JOURNAL*, and it is confidently believed that whatever doubts and fears for its success might have existed at the starting, the experience of the year has shown that there need be none now. It has supplied a want, and with success. In saying this, however, it must not be supposed that the Council are blind to its deficiencies or shortcomings,—they are well aware that it is not yet all they could wish, or what they trust it will become. The experience of the past year has shown what may be done, and affords good ground for anticipating a further success in the ensuing Session. Reliance was placed on the assistance and co-operation of the Members at large; and in this the Council did not miscalculate. To Messrs. Charley, Denison, Reveley, Sopwith, to "Cosmos," "Delta," "Waimea," and others, who have aided by their contributions, thanks are especially due for the assistance they have given.

Fresh arrangements have been made for printing the *JOURNAL* in a somewhat enlarged form, with such alterations and improvements as the trial of the past year has suggested; and it is hoped the next year will show a marked improvement in every respect. In this, the Council have every confidence that the Members of the Society, and of the Institutions in Union generally, will, in their several specialities, give their active support in communicating to its pages such information and intelligence as they must constantly have at their command, so that the *JOURNAL OF THE SOCIETY OF ARTS* may become, as it should be, a complete record of Industrial progress.

NOTICE TO INSTITUTIONS.

BOOK ORDERS.

As the time is now approaching for the receipt of the book-orders, the Secretary to the Society of Arts would be particularly obliged by the different local Secretaries adhering strictly to the instructions given in the Circular, dated Oct. 13th, accompanying the table of the rates of discount to be allowed by the Publishers. It is obvious, that, unless one uniform plan is followed, there would be much confusion and unnecessary labour; and it is hoped that all parties will assist in making the arrangement as practically serviceable as possible.

DESPATCHES OF THE DUKE OF WELLINGTON.

THE Council have much gratification in announcing that, pending their negotiations with the Publishers, they have received a communication from the Representative of the late Colonel Gurwood, offering to the Institutions in Union copies of the well-known "Despatches of the Duke of Wellington," published at eight guineas, in eight volumes, royal octavo, bound in cloth, for four guineas. The Council wish particularly to call attention to this favourable opportunity of obtaining on very liberal terms a work which, they presume to say, should be found in every public library. They will receive orders for the work, which should be accompanied by a Post-office order for four guineas, and will arrange for its prompt transmission.

NOVEL APPLICATIONS OF WEAVING TO THE MANUFACTURE OF CARRIAGE LACE.

COMMUNICATED BY MESSRS. DART AND SON.

HAVING produced a very complicated and beautiful specimen of coach lace, for the Great Exhibition of 1851, by means of the Jacquard loom; and having since made a novel application of another known principle, called "Leases," which we have patented, specimens of which manufacture, together with a few ordinary patterns illustrative of the history of the trade, have been placed by us in your Exhibition this year; a few observations on these may not be uninteresting to the readers of the *Journal*.

The great advance which has been made in this art, enabling harmony of colouring to be combined with exquisite workmanship, will be apparent to any one who will take the trouble to compare our ancient and modern patterns—some manufactured thirty-five years ago, the other expressly for the late Exhibition.

We have endeavoured to illustrate the history of these thirty-five years,—the period during which nearly all the improvements have been made,—by weaving specimens of the various styles, and placing them in chronological order. The only branches of the art known prior to 1818, were those called, "All Raised," and "Tuft on Lay." The next in order of progress received the name of "Tissue." This process, though patented in this country, was imported from France, and we had the merit of causing Englishmen to turn their attention to the subject, and to bring their ingenuity to bear upon it. Novelties and improvements were soon produced, and the manufacture to which the names of "Drawn-in Warp," and "Three-binder Vellum," were given, very soon to a great extent superseded the patent. These in their turn have been superseded by others, which are called, "Cut on Terry," invented by Messrs. Cooper and Blackford, and by Caufoy; cheap and useful styles,

but still wanting in that perfection which has since been attained.

In 1851, we exhibited in the Great Exhibition, patterns combining several novelties. In the first place the design of the figure, called by us the "Indian Bell," is new. Secondly; it is believed to be the longest, and most extensive ornamental figure ever woven in coach lace. Thirdly; it combines the different styles, figured ground, tissue, raised pile, cut on terry, and many colours. To have manufactured this pattern by "Leases," before the invention of "Tyres," or means to which we shall subsequently allude, by which the same "Leases" can be used over and over again, would have required more than a thousand "Leases," and a loom of almost unbounded magnitude.

In this instance, however, no Leases were used; but a loom, on the well-known principle of the "Jacquard," was adopted for the purpose.

The specimen exhibited in the Great Exhibition was produced from a Jacquard loom, and required three sets of cards in simultaneous operation. Since the Great Exhibition a further improvement has been brought out, and has been patented by us, and this relates to "Leases." The object is to weave in coach lace numbers and letters, so as to form words, and so to prepare the loom that many changes in the numbers or letters can be made during the process of weaving, without the necessity of altering the original preparation of the loom. This is effected with regard to letters by "mounting" the loom for the whole alphabet; and with regard to figures, by "mounting" for the nine digits and zero, in such manner that each letter and number is independent of the other—each being mounted in a separate "course;" and so that any letter or number is made to appear on drawing a string called a "Tyre." This principle enables us to apply weaving where embroidery has hitherto been used. For the police of towns, the servants of public companies, the officials on railways, &c., badges are produced by this means, good and neat in appearance, and superior to those hitherto made, both in durability and distinctness; and having the advantage, likewise, of considerable economy in price over those now produced by embroidery. There is one purpose to which the patent may be advantageously applied, viz., that of numbering the lace inside railway carriages. This, however desirable, could not be done before on account of the cost. Specimens, in which the name of the railway and a number is woven, will be found in the Society's Exhibition. Everybody knows that delay and confusion constantly occur from persons being unable to find their carriage, owing to their not knowing the number of it when they alight at stations. It is true that metal badges are sometimes attached to the inner side of the door; but persons sitting in the middle of the carriage will not probably observe it. If, however, this number were woven into every quarter of a yard of the lace with which the carriage is furnished—which would not increase the expense—it would rarely fail to be impressed on the passenger's memory. The invention is also applicable to army accoutrements; and a considerable saving might be made by the substitution of this process of weaving for embroidery in present use.

CAMBAY STONES.

CAMBAY was celebrated for its cut stones above 2,000 years ago. They are mentioned by the author of the "Periplus" as onyxes, porcelain stones, or probably jas-

pers, dyed stones, &c. Uertómenes, in his account of Cambay, in 1503, mentions "A mountain where the onyx stone, commonly called the cornelian, is found, and not far from this another, where chalcedony and diamond, abound." Captain Hamilton, who visited Cambay in 1681, says, "The cornelian and agate stones are found in this river, and nowhere else in the world. Of cornelian they make stones for signets, and of agates, cabinets entire, except the lids. I have seen some fourteen or fifteen inches long, and eight or nine inches deep, valued at 40*l*. They also make bowls of some kinds of agates and spoons, and handles of swords, daggers, and knives, and buttons, and stone seats, and snuff-boxes of great value."* In Milburn's "Oriental Commerce" they are mentioned as forming extensive articles of purchase at the East India Company's sales, though for many years past scarcely any of them appear to have been sent to Europe; China, as will be seen by the table below, taking off the chiefsupplies. Two years ago considerable exports were made from Bombay of bloodstone, in its rough state; such large profits were obtained from the earlier cargoes, that the market was glutted almost immediately, and fine specimens, which used to sell at 3*s*. or 4*s*. a pound, are now to be had in the Bombay market, in abundance, at from 2*s*. to 3*s*. a cwt.; and 28 lbs. weight of them—some eight or ten inches long, and five or six inches thick—have been purchased for a couple of rupees. Were the native stone-cutters a little better instructed in the art, and taught to make up articles to meet English taste, there seems no reason to doubt but that the manufacture might very quickly be made a most extensive and lucrative one. The stones themselves abound in the country, and are to be had at the most insignificant prices; so are the corundum, and the lac employed in cutting them; and the expensive article of diamond dust, universally employed by lapidaries in this country, where it is of the utmost importance to avoid the expense of labour, is never thought of where this class of workmen are content with 10*s*. a month, for which they will turn out as much work as an Englishman at 4*l*. Lapidaries in England complain of the Cambay stones as being badly finished, and in this state unsaleable. This arises from the want of instruction of the native lapidaries, who, if taught, are quite capable of putting any amount of finish on them that may be desired.

The following Table, taken from the Bombay Custom-house returns, gives the value of the traffic in Cambay stones, which averages betwixt 10,000*l*. and 12,000*l*. annually, one per cent. of the stones finding their way to Europe. The reader should remember that one rupee is equal to two shillings, and that there are sixteen annas in a rupee:

	VALUE OF EXPORTS OF CORNELIANS.	
	1844.	1845.
	Rupees.	Rupees.
China	73,443	59,653
Singapore.....	5,352	645
Arabian Gulf	935	18,197
Suez	—	40
Persian Gulf	2,269	1,257
Calcutta	4,179	4,913
Coromandel Coast	—	315
Malabar and Canara	89	—
Ceylon	2,536	1,540
Great Britain	100	216
Cutch	—	28
Kurrachee	—	35
Goa, &c.	53	—
Concan	1,062	—
Guzerat.....	3,460	2,000
Total rupees....	93,478	88,839

The chief articles into which they are wrought are—paper-weights, knife-handles, miniature-sized cups and saucers, tablets for snuff-boxes, sets of brooches, necklaces, and bracelets, pins, buttons, and studs. A field-gun, with all its appointments, is one of the finest ornamental pieces of Cambay stone-work: they sell at from 40 to 50 rupees.

* *Vide* Hamilton's "Account of the East Indies," 2 vols. London, 1744.

PRACTICAL OBSERVATIONS ON SURVEYING AND LEVELLING.

BY THOMAS SOPWITH, F.R.S.

(Continued from page 609.)

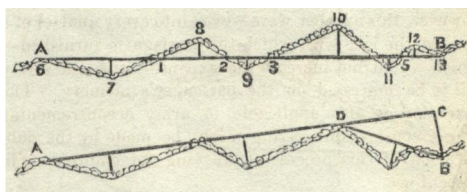
We are now arrived at the next step in the teacher's progress—the issuing forth to commence field operations; and here let me again mention with the respect I owe to his memory the obligation I feel for the service I derived from my schoolmaster, Mr. Henry Atkinson, having provided precisely the kind of instruction which I am now urging on the attention of this society. I well remember going with him to Elswick-fields, and acquiring I may say a perfect knowledge of the general principles of surveying. Mr. Atkinson was not one of those preceptors who confined his instructions to the school. When he explained the size and distance of the planets in the ordinary school lessons, he provided the telescope at his house in clear evenings, and added tenfold interest to the lessons he conveyed, by revealing to his delighted pupils the wonders which the telescope opens to the view. The microscope also was a means by which he impressed on the minds of his scholars a firm and devout conviction that Almighty goodness and Almighty skill prevail alike in the least as in the greatest of the works of Divine wisdom. It was in this manner that he laid the foundations of deep thought, and taught his grateful pupils *to feel* as well as *to know*. In like manner he brought the powers of an accomplished mathematician to bear upon the subject of surveying, and after fully explaining its general objects and method of procedure in the school, followed up these preliminary lessons by actual surveys, which enabled me not long after, and while yet a pupil in Mr. Atkinson's school, to measure the field in which Higham-place, in this town (Newcastle-on-Tyne), is built, for the purpose (and to which the plan I made was applied) of setting out the building-sites of that row of houses. And before leaving a reminiscence connected with the subject of this address, I may be permitted to mention, that the silver pencil-case I hold in my hand was given to me by a friend, for whom I made a plan at school, under the instructions not less kind than able, of this excellent teacher, from whom I received nearly the whole of my education.

The simplest forms of field-measuring may be conducted by two persons; three or four, however, are essential to any rapid progress being made. Six may very conveniently be included in one class, and rendered useful; but I do not recommend that more than that number should be employed conjunctively. The first essays may be made by the master and two pupils, who, after a few days' practice, would be able to proceed with, and impart instruction to other three or four boys. I will suppose a party of six assembled in a field—level, or nearly so. If a single field is to be measured, the requisite lines will, in most cases, present themselves to those who have read the first elements of geometry. If triangular, the merest tyro would understand that by measuring its three sides the materials are obtained for *delineating its exact form*, and ascertaining *its precise contents*. If nearly square, or rectangular, the measurement of its sides and of a diagonal line, effect the same results, inasmuch as two triangles are thus obtained. It is by simple examples and easy conditions, such as these, that young minds are brought to *comprehend* (what a world of meaning is contained in that word) the principles on which more intricate and elaborate works are to proceed; and without a clear recognition of the *reason why* each operation is performed, all solid progress is hopeless.

If the field is of irregular form, the students are to be exercised in devising what number and direction of lines will most readily furnish the two objects required; viz., the means of delineation and admeasurement,—an exercise which may at times be practised in the school, by giving the pupils imaginary forms of irregularly-shaped fields to be filled in with suitable side lines and diagonals. And here the difference between theory and practice soon becomes apparent. I have known pupils taught to measure an offset of some eight or ten feet by setting off a perpendicular from the main line, whereas very little practice will suffice to take offsets of ten times that length by judging of the perpendicular by the eye. The cross-staff recommended in some works for that purpose is therefore in general practice useless, although as explaining a principle it tends to impress the object aimed at more forcibly on the mind. It is not easy to *teach* approximations, or to explain to the uninitiated what skill and practice only can attain,—a small cross-staff, such as may be made by a common carpenter, suffices to exhibit the principle. A young scholar is thus taught that the offset is to be measured from a given point in the main line where the cross staff is placed, to some definite object,—as a tree, a gate, or part of a fence—such line being exactly square, or forming an angle of 90° with the main line. Here is a clear, definite, distinct work to be done, and the means of doing it; a very little practice will supersede the use of the cross staff, but the pupil will ever remember that the eye is required to supply its place—not by attempting an indefinite approximation, but by the fulfilment of an exact and well-defined duty.

In selecting lines to be measured with the chain, the following considerations constantly come into practical use: viz., 1st. That it is desirable to make the first line as long as the place to be surveyed admits, in order that it may form a convenient base for the further lines to be connected with; and this is to be aimed at regardless of whether such line passes near the fences, roads, or other objects. In a triangular piece of ground the longest side would form a proper base, and also afford the means of measuring the adjacent fences. In a square-shaped piece of land or parallelogram, the diagonal being first measured forms a base for two triangles upon it, and in a large and irregular estate a line is to be selected stretching through its greatest extent. 2ndly. The other lines are, generally speaking, to be set out with reference to two points; viz., to be as near to hedges or other objects as practicable, having regard also to facility of measurement; and the judgment of the surveyor is called into exercise very frequently to decide between these two conditions. In measuring along a crooked fence, for instance, the line, A B, (fig. 7,) is the nearest

Fig. 7.



average distance from the fence to be measured, but it involves no less than five crossings of the fence; and at each of these there is not only the difficulty of straightening the chain,—that is, extending it truly so as to be a correct measure of length,—but there is often a difficulty in seeing the general direction of the line;—add to this

the loss of time occasioned by the assistants' having to climb over or to creep through, or go to some distance; and it is apparent that these impediments far more than counterbalance the theoretical value of proximity. In the lower figure a line, A D, continued to C, is measured without interruption, as are also the lines C B, and B D. In the upper figure, then, we have on the line A B, five crossing-places if that line is adopted, and the angles marked 6, 7, 8, 9, 10, 11, 12, 13, require notice in the field-book. I take these examples, to show the manner in which the entries would be made in both cases, not only in the form commonly adopted, but also in that which, though not so well known, or so generally used, is yet I think decidedly the best.

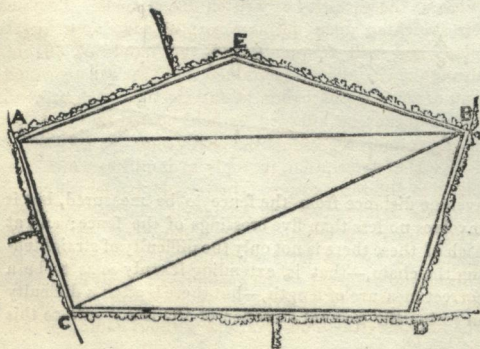
The following Fig. 8, being the respective field-books; in the right hand form, the line marked C L is that which represents the course of the chain, or chain line, and though the type does not admit of the sketch itself being shown, it is easy to perceive that a very near resemblance to a correct drawing may be made, the same as in the upper and lower plans of Fig. 7, on the lines A B, A C, &c.

Fig. 8.

<div> <div> <div>14</div> <div>990</div> <div>930</div> <div>910</div> <div>865</div> <div>830</div> <div>740</div> <div>556</div> <div>510</div> <div>470</div> <div>40</div> <div>390</div> <div>282</div> <div>170</div> <div>00</div> </div> <div> <div>30</div> <div>20</div> <div>40</div> </div> </div>	From point A. to B.	<div> <div>14</div> <div>990</div> <div>930</div> <div>910</div> <div>865</div> <div>830</div> <div>740</div> <div>556</div> <div>510</div> <div>470</div> <div>40</div> <div>390</div> <div>282</div> <div>170</div> <div>00</div> </div> <div> <div>30</div> <div>20</div> <div>40</div> </div>
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The following Fig. 9, represents a field of irregular shape. The line, A B, is measured without any offsets being taken; B C, and C A, with C D, and D B, complete the trapezium, and A E, and E B, enable the

Fig. 9.



surveyor to take convenient measurements to the irregular fences indicated by these letters.

I have taken these simple examples, in order to point out the first operations in field surveying; viz., the selection of lines in order to throw the ground into geometrical forms. And here is a practical consideration connected with the subject as regards schools; viz., that as no great portion of the teacher's time can be devoted to so small a minority of his scholars as a surveying class, it is desirable that the principles and practice should be explained as fully as possible in the school. This selection of lines, and arrangement of geometrical forms, may readily be explained by means of figures drawn on that indispensable aid of every teacher,—the black drawing-board; and, habituated to such instructions, the elder pupils may be enabled to shape their course in the field, and exhibit the accuracy of their work to the schoolmaster, without the necessity of taking him from the rest of the scholars, except only at occasional and brief opportunities, as for instance, on summer evenings or holidays, when it is not unlikely that many younger pupils may have acquired some curiosity on the subject, and so become spectators of the survey.

It would render this paper much too prolix were I to enter upon a description of all the lesser details which occur in the practical operations of measuring land; nor are they, generally speaking, such as require to be pointed out to the intelligence and activity of a superior class of pupils, and still less to the well-informed and respectable body of teachers, who have shown their great regard for the dignity of their calling and the extension of their usefulness by considering the cultivation of science and the diffusion of knowledge from a uniform source of information; as in the case of lectures, or papers, like the present. It will rather be my aim to condense such matters, well knowing that minor details are best left to individual judgment and experience. In first commencing field surveys with a party of scholars, I will therefore put, in as brief a form as I can, some of the considerations which are to be kept in view in a class of six pupils.

1. The parties in the survey are to have their respective duties assigned. The teacher, when present, is to see that *all* perform their several parts; he is the observer and adviser—the entire operations are to be begun, continued, and ended by the pupils.

2. To one is assigned the position of conductor, or manager, whose instructions the rest are to obey. He takes the field-book, directs what lines are to be measured, and upon him rests the responsibility of accuracy in all the operations; other two take the chain, the one acting as the leader, pulls forward the chain; the other, called the follower, carries the other end; the fourth takes the offset-staff (which, in practical surveying or in a small class, may be done by the conductor), and measures offsets, occasionally assisted by one of the others, in measuring buildings with a tape-line; and the fifth and sixth carry the flags, set them in straight lines, as desired by the conductor; and, in extensive surveys, this "setting out" of lines affords ample employment for two assistants.

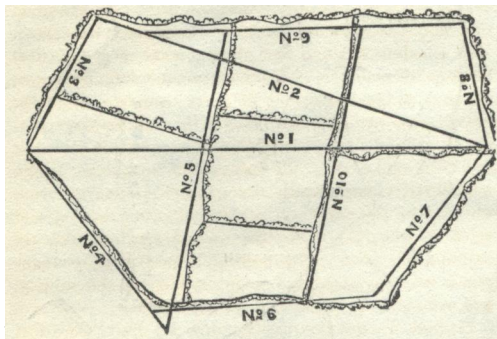
3. The conductor will ascertain that the chain is of correct length before commencing the survey.

4. The greatest care is requisite on the part of the chain-bearers that the chain is exactly upon the required line—that it is fully stretched out—that there be no yielding or movement from the place of commencing each chain length; that no crooks, nor doublings up, nor bendings have happened, and to change the pins at every eleventh pin; when the follower, allowing the

chain to be on the ground, walks up to the leader with ten pins or arrows, which he counts over to him, and sees one arrow put in the ground.

In the following Fig. 10 are represented seven fields of irregular shape, and it will only be necessary to inspect the lines representing the course of the chain in the order in which they are numbered, to understand the manner in which the whole area is embraced in a series of triangles.

Fig. 10.



The main line, No. 1, is taken in the direction of the greatest length of the estate, and the distances at which the several hedges are intersected are carefully marked. Small pegs, or a ticket placed under a stone, are also noted in the field-book, in order that any future connection of other lines may be easily ascertained. Whilst the conductor and his assistants are measuring the line No. 1, the flag-bearers select a point under the general instruction of the conductor at which the line No. 2 terminates, and No. 3 commences, so that a great triangle is thus formed. Nos. 4 and 5 complete a second triangle. No. 5 ending on the line No. 1, either close to some mark which the conductor has left in contemplation of such junction, or at a spot which is so many links distant from the intersection of the hedge. No. 5 in the field-book is therefore described as commencing from a given length in No. 4, and ending at the ascertained length in No. 1. This line is afterwards continued to No. 9, either as a continuation or a tie line. From a convenient point in No. 5, which has thus been "fixed" as a line, No. 6 commences, and No. 7, connecting it with No. 1, completes a trapezium, and Nos. 8 and 9 form another triangle; which comprises with those already named the general outline of the estate. The line No. 5, continued to join No. 2 and No. 9, affords additional proof of the correctness of the survey; and this line and No. 10 enable the conductor to measure the irregular fences near them. As to the other fences, which are straight, it is only requisite to mark on the lines, Nos. 3, 5, 10, the distances where such straight fences intersect, or *where they would intersect* if continued in a straight line; or, in other words, either the place of the fence, or the place of its *line of direction*, enables the draughtsman to delineate it from the measurement so recorded.

I do not think it necessary to multiply examples; I am rather desirous to put in the simplest possible form a few illustrations which exhibit the general principles to be acted upon; for when these are clearly understood, their application to particular cases will readily occur to those who, like the teacher, are accustomed to geometrical forms. In describing the field operations, however, it may be well to introduce an example of the details included in the field-book.

First, then, it will at once appear obvious, that if in

measuring a line we attempt to record it by writing downward on the page, we shall find our record travelling backward, as it were : that is, in a direction exactly contrary to that in which we are looking; and this reversal of everything is an element of great confusion and complexity, if we consider the field-book as being in some measure a picture, or representation, of the objects to be measured. The remedy for this is to begin at the bottom of the page, whereby the whole page lies *before us*; exactly in the same manner as the fields or other objects are before us.

Fig. 10.

	21	1545	
	15	1495	
	10	1425	
6-6	53-18	1353	
125-100-70	56-15	1270	
137-110-82	65-28	1158	
137-109	82-50	1100	
136-108-78	52-13	1050	
138-113-82	70-40	935	
140-130-105	70-10	770	
140-105	70-60	720	
90	70-25	680 60	
	60-50	660 30-87	
	33	611 40-85	140
	22	590 24-63	110-150
		555 37-73	113-152
		500 30-55	88-120-160
		475 42-80	118-148
	35	422 42 90	121
	115-50	370 58-100	
	97-48	330 60	
154	192-130	90-50-18	270 80
160-120-82	60 25	110 20	
120-150-130-90	60-30	00 70	
		15	

Opposite the 12th milestone on the road leading from H. to I.

No. 1 commencing at the south boundary, on the east side of rivulet, and parish of D., county of E. By F. G., May 1st, 1848.

Survey of an estate belonging to A. B., Esq.,
situated at C.

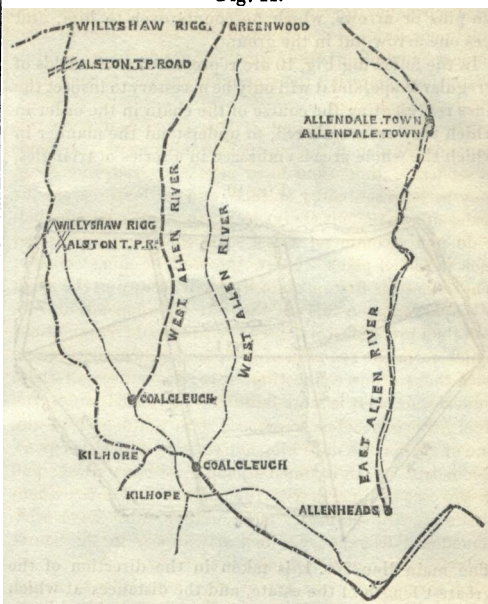
First; the description of the place, name of proprietor, and date of survey are entered; and next, some brief description of the place where the first line of measurement commences. At this point of commencement the surveyor measures *back* 15 links to a fence, and the starting-point is marked by two ciphers. At this starting-point the surveyor finds on his right hand a fence, 70 links distant; a footpath on the very place of commencement; a small rivulet—of which the east side is 30 links, and the west side 60 links—lies to the left; beyond this is a turnpike-road, the sides being respectively 90 and 130 links; further on is a milestone, and beyond it a fence. These several distances are recorded in the columns of figures, and a rude sketch is made on the chain-line of the field-book as already described, by which the *relative* position of the objects is kept in mind without the necessity of written descriptions. This line for sketching upon, forms a sort of rude approximate plan, and will frequently, in the hands of an able draughtsman, afford a tolerable idea of the exact position, and distances, and points of intersection, such as could by no means be afforded by field-books, in which the figure column represents the chain-line.

A verbal description, in reply to inquiries which may occur to different persons, is better adapted for conveying accurate information on numerous matters of detail which occur in practice, and which may, in fact, be treated in various ways without any detriment to the substantial accuracy of the geometrical conditions which are requisite. To enlarge on these would only extend the length of these observations without adding to their

practical value. I would therefore, in reference to such details, rather express the hope that no enlightened member of the professions which are based on the practice of surveying and levelling will ever withhold from the teacher such occasional advice and information as he may be able to afford, for he is thereby following out an extended and benevolent plan of education, which, by embracing a portion of scientific practice, will in time lead to a more general appreciation of science. It is this desire, warmly felt and earnestly carried out, which can alone lead to any great extension of a practical love and knowledge of science. I entirely disapprove of the attempts—which belong rather to former ages than to the present—of shutting up knowledge as a craft and mystery. The men of mystery learnt their own art, but they knew not, and they cared not, for the “mysteries” of others. Hence, not understanding them, nothing but absolute necessity drove them to resort to them; whereas, had the general objects and advantages been known, it is probable that a public appreciation of such advantages would have led to a greatly increased demand for the services of those who, by long practice, had acquired that due knowledge and rapid execution and skilful appliance which long-continued practice can alone impart.

The state of ordinary field surveying, as a useful science, is very far behind what it ought to be. In many large estates no accurate plans exist, and throughout England I believe the number of really scientific plans of landed property is very small compared with the intrinsic value of such records. Many of the plans sent to the Tithe Commissioners were, in point of execution, inferior to what ought to be easily attainable by the limited exertions of the pupils in a village school. By scientific plans, I mean those which are based on correct geometrical principles, and measured with due attention to accuracy as regards the direction of lines, and the correct measure of length. Contiguous estates thus measured, and thus planned, would correspond exactly in their boundaries; experience, however, shows that such correspondence is very rarely to be found in plans of different estates made by different parties. Some opposite examples have reached the extreme limits of absurdity, as in the case of a district plan described to me by the Director of the Ordnance Geological Survey of England. The various proprietors furnished their several plans, which were fitted to each other, beginning with the outer boundaries of the entire district, or parish; and when all were so delineated, there remained a space wholly vacant in the centre, on which the perplexed draughtsman, in order to convey a true idea of the case, inscribed, “This is nothing.” Scarcely less amusing was the indifference of a landed proprietor, who showed me a plan of his estate. “I do not see the plantation,” said I. “Ah, very true; the plan was made by the parish clerk, and I think he has forgotten it. This field, too, is wrong—it *should be here*,” pointing to the other side of the plan. By no means uncommon is it to find, on adding details of brooks and rivulets upon old plans, that they are found apparently running up, instead of downhill; and an example of the great amount of error arising from the use of old and inaccurate plans may be found in county maps, not only as between different counties, but even in the representation of the same county—a difference in a well-defined portion of the western boundary of Northumberland, in the maps respectively published by Fryer and Greenwood, amounting to upwards of two miles; as in the following reduced Fig. 11, where the boundaries are denoted by differently dotted lines. The distance between the rivers East and West Allen

Fig. 11.



varies about a mile, and the distance between Kilhope and Willyshaw Rigg is more than two miles longer on one map than the other. Yet these are the best maps hitherto published, on a large scale, of this county; nor is there any portion of it where accuracy is more desirable, owing to the rich mineral deposits of which these lines of county divisions form the boundary. In short, the representations given by many old maps are frequently so erroneous as to be of little or no practical use; and if the practice of surveying becomes more generally known, and the value of plans more generally appreciated through the instrumentality of the teacher, the professional surveyor will assuredly be benefited; and hence I deem it not less prudent than generous, for every one to aid the teacher in imparting sound general views of all such departments of knowledge as enter into the business of after life, and which admit, as surveying most certainly does, of being included in the routine of school education.

The survey completed, the next operation is the delineation of the lands on a PLAN. For this purpose I recommend a tolerably large table, either level, or with a very slight inclination—the ordinary school-desk is too narrow and too steep. Next, it is requisite to have a stock of common cartridge-paper, on which the lines are to be laid down by all the pupils in succession, and a few sheets of drawing-paper, on which a *fair* or finished copy of the plan may be made by more advanced pupils. The other materials required for this drawing or planning class are—black-lead pencils (observing that the commoner sort of pencils leave a mark which is not easily effaced, which is an advantage for writing in the field-book, but for plan-drawing it is desirable to use pencils of a better description, in order that the lines may be taken out); India-rubber; a straight-edge of wood, but steel is better if the funds permit; a *rolling* parallel ruler, about twelve inches in length; scales of chains, one, two, and four chains to an inch: the best scales are of ivory, but cheaper ones are to be had sufficiently clear and good for common use, made of box-wood, and others still less costly and very convenient for use, though of course less durable, are printed on cardboard; a pair of compasses,

with moveable legs; a good drawing pen; Indian ink; steel pens for ornamental lettering; a few cakes of good colours, including lake, gamboge, and Prussian blue. With these materials the student is enabled to commence his drawing or plan.

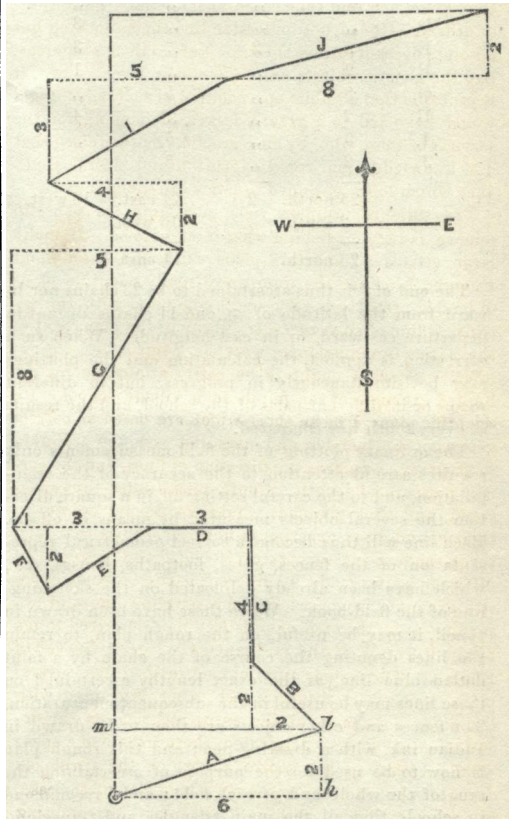
The first consideration is the *scale*, and upon this depends the size of the paper. If only one or two fields of moderate dimensions have been surveyed, one chain may be represented by an inch, and for larger areas the scales of two or four chains to an inch may be adopted. I do not recommend a less scale than four chains per inch in school plans. Next, the student must consider what place his first or main line will occupy on the sheet of paper, as upon this all the rest will depend, and he will then proceed to lay down the principal triangulations which form the skeleton of the plan, following these up with the various connecting lines; for unless all these coincide, or, as it is more familiarly expressed, unless the lines *fit*, it is needless to proceed with the details of any one of them: the only alternative is re-admeasurement. Geometrical truth is aimed at, and must be attained; and in the case of surveys with the chain alone, it is evident that some neglect in the manipulation must have occasioned any discrepancy which may appear in the course of laying down or "*plotting*" the survey.

In surveys of great extent, and especially in mountainous districts, or where ravines of considerable depth and winding course happen to be features of the scenery, the chain alone is scarcely adequate as the only basis of the measurement. In such cases, the *dial* or *theodolite* are called into use. In extensive surveys of this description I have almost invariably used the dial or plain circumferentor, in preference to the theodolite; it is more portable, less costly, presents a wider surface on which to observe the bearing or place of the magnetic needle, and the accuracy of operations performed with this instrument have been tested again and again by the most exact coincidence of surface and subterranean surveys. But whether the circumferentor or theodolite is used, it is obvious that the same principle and mode of reading applies to both. In chain surveying, a *framework*, as it may be called, of *fixed lines*, enables the surveyor to note down every line as beginning at a certain point in a former line, and proceeding to another given point in another line; and so in like manner the laying down or plotting of the lines is easily accomplished, all that is necessary being to measure off the given positions: then draw a straight line connecting them, and if the length of the line thus drawn corresponds exactly with the actually measured length, a strong proof—amounting in some cases, but not all, to demonstration—is afforded. The dial enables the surveyor to proceed from any point in a number of varying directions, which are recorded in the book in the manner already explained; and in order to lay these down on the plan, it is necessary to fix the direction of the meridian line—that is, of the magnetic meridian—and from that line the degrees and minutes are marked off, accordingly as they are east or west of the north or south point of the circle or graduated protractor. In practising with the dial, or circumferentor, for the first time, the pupil should be made to take bearings in four consecutive lines, of one or two, or more chains, as the ground will permit, and at angles varying from each other by 90 degrees, thus—N. 10 E., S. 80 E., S. 10 W., and N. 80 W.; when the end of the operation ought to be exactly at the point of commencement. This practice, and also the drawing of a square on paper, will afford a learner a far more vivid idea of the difference between theory and practice than any description. If, then, a square—one of the simplest of all forms—be so

difficult, it is quite obvious that equal or greater difficulty must rest upon all other more complex forms.

In laying down extensive lines of bearings, I have found it useful to apply, as a check upon any occasional error in plotting, the ascertained latitude and departure of every tenth observation—a method so well known by its constant use in navigation as to require only a reference to works on that science; and for the objects of the present paper, it will suffice to give a plain example of the principle. The following Fig. 12 represents, by a strong black line, ten lines of which bearings are supposed to have been taken and laid down; these lines are marked by the first ten letters of the alphabet. By reference to tables, or

Fig. 12.



by calculation, it is found that the end of the line A is 6 chains east of \odot , by which mark the point of commencement is denoted, and which sign or mark will be used for brevity throughout this illustration; and it (the end of the line A) is also, by means of its oblique direction, 2 chains north of \odot as regards latitude, which term is used in navigation in the same sense as in geography; but the *easting* or *westing*, or difference in longitude, is called "*departure*," meaning departure from the longitude of the point of commencement. Hence it will be easily understood that if we ascertain from a table, or from calculation, the latitude and departure of any bearing and distance, we may lay it down by rectangular lines, as $\odot h$, $h l$, or $\odot m$, $m l$. In like manner the end of B is 2 chains north and 2 chains west of its point of commencement; the latitude of the end of B is therefore $2+2$, or 4 chains north, and $6 \text{ ch. east} - 2 \text{ ch. west} = 4 \text{ ch. east}$, departure. If, then, we add all the northings and southings of the ten lines separately, and take the lesser

from the greater, we shall have the final result or difference of latitude between \odot and the end of the tenth line J; and the like operation with the east and west directions will give the final difference of longitude, coinciding, of course, with the respective lengths of a single line on the meridian, and a single line of latitude drawn from the longitude of \odot to the end of the tenth line J. In the example before us we have the following lengths and directions, which I have made as plain and simple as possible, in order to elucidate this mode of practice to any who may not be familiar with its use in Surveying:

	North.	South.	East.	West.
A.	2	"	6	"
B.	2	"	"	2
C.	4	"	"	"
D.	"	"	"	3
E.	"	2	"	3
F.	2	"	"	1
G.	8	"	5	"
H.	2	"	"	4
I.	3	"	5	"
J.	2	"	8	"
	25 north.	2	24 east.	13 west.
	2 south.		13 west.	
	23 north.		11 east.	

The end of J is thus ascertained to be 23 chains northward from the latitude of \odot , and 11 chains distant in departure eastward, or in east longitude. When such correction is applied, the calculation and the plottings may be simultaneously in progress, but in different rooms or in different parts of the school, and the results at every tenth line compared.

The ordinary plotting of the field measurements only requires careful attention to the accuracy of the triangulation, and to the careful setting off in a square direction the several objects measured by means of offsets. Each line will thus become a correct geometrical representation of the fences, gates, footpaths, houses, &c., which have been already delineated on the sketching-line of the field-book. When these have been drawn in pencil, it may be useful, on the rough plan, to retain the lines denoting the course of the chain by a faint dotted blue line, as the exact lengths ascertained on these lines may be useful in the subsequent mensuration. The fences and other objects are then to be drawn in Indian ink, with a drawing-pen; and this rough plan is now to be used for the purpose of ascertaining the area of the whole and of each field: and I recommend in schools, that all the main triangles and trapeziums be calculated with the needful additions or reductions necessary to ascertain the total area, and afterwards each field to be separately calculated. I deem it wholly superfluous to occupy your time with any details of mensuration, inasmuch as the ordinary modes of calculation are based on very few and simple problems, which the pupil ought to be entirely master of before he enters on any course of surveying or levelling.

A transfer to drawing-paper for a clean copy or duplicate may be made by means of pricking holes from the rough plan, by means of the pentagraph, by drawing squares, or by a sheet of black-lead tracing-paper, which, under a gentle pressure caused by a blunt point carried over each line on the rough plan, transfers the copy to an underlying sheet of white paper. In some offices a large plate of glass is used, and a copy made by means of the transparency. Much practice is required in all these modes before a practical efficiency can be gained, and any of them serve to accomplish the required

purpose. Of course, only the lines of fences, houses, &c., are to be transferred; the chain-lines, and lines used in mensuration of areas, may remain on the rough plan.

It is now usual to finish plans in a much more plain and simple style than what is recommended in many works on surveying. The fields are not shaded with lines or dots, to represent ridges, and fences are usually shown by plain lines, coloured to show boundaries, and with signs indicating to which proprietor the boundary fence belongs, the place of change being marked χ . The names of fields may be inserted in italic letters; of houses, in small Roman letters; and the names of adjacent estates and properties may be inserted in plain and conspicuous lettering, avoiding all unnecessary ornament. The scale is of the greatest importance, as is also the bearing of the plan as regards its position to the meridian; and, unless some great objection occurs, it is well to have the top of the plan towards the north. The title may admit of some ornamental lettering; but a few inspections of well-executed plans by skilful surveyors is worth a world of description, and such opportunities of inspection and of copying plans may, I trust, often be afforded to those who desire to avail themselves of such means of placing really good models within the reach of their pupils. I do not know of any published work which contains such plain and useful examples of drawing as are adapted for school purposes. Many of the examples which appear in some such works run wild, if I may so express it, into a quantity of elaborate detail, which must utterly confound and perplex both master and scholar, who are aiming only at practical usefulness. Even the Instructions issued from the Tithe Commission Office in 1837, were not free from this exuberance of detail—this overflowing of signs and symbols, many of which were not only unsuitable, but even impracticable. Indeed, the whole progress of that survey was a lamentable proof of the want of general information on the subject; for, by the adoption of a system which I submitted to the Chairman of the Commission of Inquiry, a national survey might have been completed under very simple and inexpensive arrangements, combining general accuracy with abundant leisure for filling up detail from time to time; and by the adoption of a similar system on a less scale, a number of landed proprietors might procure a scientific basis, or frame-work, of a large tract of country, the separate portions of which might be filled in by the surveying classes of village schools—and that, too, with such checks as to ensure accuracy.

The art of LEVELLING can only be considered as an extension of that of Surveying—the one having reference to the measurement of vertical contours, the other to the measurement of horizontal or slightly inclined areas. The books and other materials used for the one are nearly the same in the other, with the addition of an instrument for taking levels, and a levelling-staff. The principle of levelling may be illustrated by a level of a plain and inexpensive description, and by a painted lath of ten, twelve, or fourteen feet. Whenever a survey embraces ground which is otherwise than level or slightly undulated, the process of levelling becomes necessary, in order to ascertain what reduction is necessary to reduce the hypotenuse to the base of the right-angled triangle, formed by a horizontal line from the bottom of a steep inclination, and a perpendicular line at the other extremity. Some surveyors ascertain the angle of inclination, and make a reduction accordingly at the time; but I recommend an approximate levelling, or a memorandum of the inclina-

tion, to be recorded in the field-book, and the distances transferred to a base line from a hypotenusal line, corresponding with the inclination. This, like many other of the minor details of surveying and levelling, is better explained by a single example than by many pages of description. The same remark applies to the manipulations required in adjusting the more elaborate forms of the spirit-level; but in practice I can scarcely imagine any of these more costly instruments being in the hands of any but those whose opportunities of gaining accurate information, supersede the necessity of prolix directions in a general paper of this description. For instance, the very purchase of an instrument of the value of 10*l*. or 12*l*., implies the means of access to books, and the opportunity of information, which any salesman of such a level would willingly impart. The admirable little treatise, published by Mr. Sims, ought to be in the hands of every teacher who has pupils sufficiently advanced to go into these refinements of the art. The same observation applies to the levelling-staff, of which there are various descriptions; but for the ordinary purposes of school education, a plain-painted lath may suffice for the measurement of inclinations. Different forms of recording levels are adopted by different surveyors, and recommended in different works. The following, Fig. 13, is the form which in practice I most prefer, and which originated, I believe, with Mr. Robert Stephenson, whose early attention to the union of mathematical studies with practical engineering laid the foundation of the eminence he has since so deservedly attained.

Fig. 13.

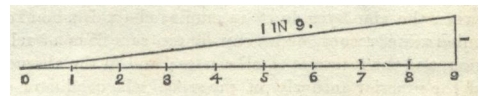
Levels of the T. P. road, from A. to B. May 1, 1848.
Datum 50 feet below threshold of door.

3-50	50-00 9-40	5-20	50-00 4-20	R	Above datum.
			54-20	R	
6-60	13-70	2-10	11-60	R	
			65-80	R	
7-40	3-15	10-45	7-30	R	
			58-50	R	
10-90	2-75	12-55	9-80	R	
			48-70	R	
13-75	1-60	11-70	10-10	R	× Toll-bar.
			38-60	R	
16-25	5-40	0-15	5-25	R	
			43-85	R	
19-95	11-45	1-54	10-30	R	
			45-15	R	
21-90	12-95	1-10	11-85	R	
			66-00	R	
24-15	7-05	4-25	2-80	R	
			68-80	R	
27-60	4-25	6-15	1-90	R	Opposite House.
			66-90	R	
31-00	6-15	10-90	4-75	R	B.M. on door thresh.
			62-15	R	
34-50	5-40	9-65	4-25	R	
			133-25 75-35	R	at B.
			57-90	R	

For delineating levels, the same materials as in surveying are necessary; and, in short, it will be found that when a class has become well acquainted with the principles and practice of surveying, they

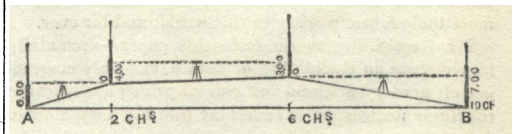
will readily acquire the knowledge of levelling, assisted by the occasional aids to which I have alluded. In the field, the chain-measurements are the same; the plotting of the lines levelled over is made by means of a scale of lengths, and the section is plotted either to the same, or to an enlarged scale, according as the nature of the case requires. There are two considerations which appear worth naming: the first is, that the student's first field-levelling should be a circuit ending where he began; for if all the elevations taken exactly equal the depressions, nothing can be a surer test alike of the accuracy of the instruments employed, and of the care in using them. The other is, that whatever distortion of scale be adopted—as, for instance, four chains to an inch in length, and forty feet to an inch in height; the pupil should also lay down the section on a true scale—that is, four chains to an inch in length, and four chains, or 264 feet, in height; by which means he will obtain a correct idea of the small amount of variation in long distances, between a horizontal line and the contour of hills; upon which a fallacious idea obtains in most minds—many persons, for instance, in sketching a line to represent the inclination of Dean-street, in this town, would draw a line two or three times more inclined than the case requires—the steepest part of it rises one foot in nine; and a line rising at that rate

Fig. 14.



appears to the eye much less steep than would be supposed on a view of the street, owing to the foreshortening, which presents the full height, but lessens the apparent distance. The following figure 15, represents the

Fig. 15.



Levels from A. to B.

2-00	6-00	0-00	6-00	R	
6-00	4-00	3-00	1-00	R	
			7-00	R	
10-00	0-00	7-00	7-00	R	at B.
		10-00	0-00	R	

mode in which the levelling instrument is placed for taking two observations at each setting; and the results, as marked on the diagram, and recorded in the field-book or levelling-book, presents a ready index to the more complicated examples, which, being only a repetition of the like operations, are equally simple in principle.

I have endeavoured to present such a general outline of surveying and levelling as may bring the subject fairly within the consideration of every member of this respectable and useful Association, which by the selection of such a subject has evinced a desire to extend the range of ordinary teaching, and to base such extension not upon the various recommendations of writers who have entered into numerous and sometimes complicated details, but upon such as might be furnished by one accustomed to the practice of the art in this district, and in the present day. I greatly esteem the honour done me by the request of the association, and still more highly will I

esteem it, if it shall be found to conduce to some practical end. I have endeavoured to indicate the manner in which the reading, writing, and calculations of the surveyor may be made an attractive object of indoor study prior to the more advanced students' adventuring into the field. The class, when in the field, are by these preliminary means enabled to proceed without the constant attendance, and, indeed, with only occasional attendance, by the master or chief conductors of the ordinary business of the school. The drawing operations bring the students again under the teacher's eye in the school. Under such conditions, extreme order and strict discipline are duties which devolve on the pupil entrusted with the conducting of the survey. With firmness, order, and decision, he is to unite gentleness and courtesy to the pupils employed under him; and this in itself, let me observe, is *education* in one of its highest and most important forms. Harshness, rudeness, haste, are inadmissible in the conduct of the director; activity and willing obedience are to be inculcated on the subordinate members of the class. No opportunity is to be lost of impressing such sentiments—they alone can render the proceedings of a class harmonious and agreeable. "Let gentleness your strong enforcement be," is the true maxim in every department of life, whether in or out of school; and I take this opportunity of saying, that there is much need to apply this in general practice as between the employer and the employed—it is a bond of union alike recommended by all the sanctions of religion, and the interests of all classes; and in the absence of the superior authority of the school, the conductor of a surveying-class will find it the only means of maintaining a due subordination. By this means the field-practice would in reality become a sort of holiday—an occupation of healthy and pleasurable excitement; a means of encouraging active merit, and training young men not only in an agreeable and useful pursuit, but also in some of those qualities which tend most to promote their future welfare in this world, and for ever.

I am unwilling to conclude this paper—necessarily imperfect as an elucidation of details, and only embracing elementary progress and general principles—without offering a suggestion which may possibly be found of practical use in attaining the ends for which it is to be presumed this paper has been requested; viz., the advancement of surveying and levelling, as a branch of education in the schools of this district, through the instrumentality of this Association. It is this,—that a select Committee be formed of members of the Association to take cognizance of the subject by obtaining needful information, and by procuring in the most convenient places, and at the least possible price, such instruments and materials as may be required by teachers about to introduce the methods I have described, or any similar system, as a part of the education conducted in their respective schools. For example; if ten, or fifteen, or twenty schools were about to include surveying as a branch of the ordinary routine, the instruments, field-books, pencils, paper, &c., &c., could be obtained in wholesale quantities, and some cheap formula or directions prepared under the sanction of such committee, to whom applications for all such information could be addressed.

One of the first duties of such a Committee would be to ascertain the *least cost* at which the absolutely indispensable materials could be had for village schools, to furnish such information, as well as supply such materials at wholesale prices, thereby securing a uniformity throughout the district. I throw out this recommendation

because I am persuaded that many teachers of the humbler class would seek for, and probably be encouraged to obtain from such a committee of teachers, information and materials which he would scarcely know how to apply for in the several establishments where they are respectively sold. Such an arrangement would possibly have, in some degree, the effect of giving an additional importance and business-like character to the Association; and as I would have the whole of these purchases and distributions detailed in your annual Report, I need scarcely say that the public would thus obtain an additional means of knowing in what schools arrangements of this practical character were in progress; nor would I despair of such proceedings being regarded as an additional claim on the encouragement and support of the public. It is with reference to some such result that I have mainly studied the character of this paper; and I can only once more express the gratification I shall feel if any permanent advantages can be conferred either upon the schoolmasters or the scholars in the north of England by introducing or extending this or any other of the useful arts as a part of ordinary education.

HOME CORRESPONDENCE.

CONSUMPTION OF SMOKE.

Price's Patent Candle Company, Belmont.

DEAR SIR,—Your note of the 31st October asks the question so generally, that I think the best answer is to give you our experience as smoke-consumers from the beginning. We went through the usual ordeal of projectors with schemes plausible enough to make us try them, and these failing, we were discouraged in making further attempts, until, on establishing a branch manufactory at Battersea, our neighbours complaining of the smoke made us try again.

We then began with Keymer's patent. His plan is to use anthracite, with a fan, the fire-bars being set in troughs of water: this furnace gave a splendid flame, without smoke, and got up steam very quickly; but the supply of the coal becoming very irregular, and the price rising, led us, in 1846, to try Inche's patent plan, which we were told gave the same perfect absence of smoke, and with cheap coal.

We continue to work these original Inche's furnaces (the bars of course having been renewed), and have put up others more strongly constructed and less liable to break down, especially since the addition of clutches to throw them out of gear on a strain coming beyond that which they are calculated to resist. A person named Hazeldine was employed in putting up the earlier of our Inche's furnaces, who, observing that we had a 90-horse marine boiler with four fireplaces, in which we continued to use dear fuel, offered to fit up an apparatus that should work as well as Inche's, be cheaper in its first cost, and yet go into the small furnace space. We promised that if he did as he said, we would recommend his furnace among our friends. We put up one, worked it several months against its three neighbours, which burnt coke as before, and being well satisfied with the results, altered the three to his plan; and finding these succeed, and our former moves having been successful—the making no smoke, and using cheap fuel—we were induced to try a third—a cheaper apparatus—to effect these results, and ordered a large apparatus, under Hazeldine's patent, for a 30-horse boiler: this answered perfectly. Soon after we were recommended to try Hall's patent; and after seeing it at work at the Post-office, and that the principle

was the same as that of the other two, and that the apparatus was promising, we put up one of each—Inche's, Hazeldine's, and Hall's—under three exactly similar 30-horse boilers, having distinct feed heads. These, after we had measured the water let in, and weighed the coals used, led us to the conclusion that the only points to look to in future were, the first cost of the furnaces, and their liability to get out of order. Latterly, some of the engineers connected with the Sydenham Crystal Palace, who were considering what furnaces to put up, asked to see ours, and for our opinion. We told them that, as engineers, they were competent to judge for themselves; but that they were welcome to try any experiments, to ask any questions, and on reporting the answers, that we would see that they were correct—our only stipulation being, that they should tell us the conclusion they came to. They chose Hazeldine's. At some new works we are now putting up near Liverpool, we have fourteen 35 horse-power boilers. Having thought that the proprietors of Inche's patent had not behaved very wisely towards us, believing that they had put up furnaces cheaper for new customers than for us, their old ones, we told them that unless they knocked off some patent royalty, we should put up all our furnaces upon Hazeldine's plan. They met us reasonably, so we determined upon six of theirs and eight of Hazeldine's. We offered Mr. Hall, if he would charge only a moderate royalty, to put up one furnace under his plan, that he might be represented, and that we might say at Liverpool, as we can say here, that we work three distinct smoke-consuming apparatus, all giving perfect results; but he stuck by his high royalty, and refused.

You will not wonder, after the above, that it seems odd to us to hear of the impossibility of consuming smoke, and to see people, regardless of their pockets, sending good fuel up their chimneys to annoy their neighbours. I should have mentioned, that our judgment has been formed upon nineteen smoke-consuming furnaces at our works at Battersea and Vauxhall. I believe, however, that one reason why none of the above furnaces have come into more general use is that, apparently, the proprietors have tried to make money by a high royalty on a few furnaces, instead of tenfold the amount by a small royalty on a great many furnaces. All three plans are perfect smoke-consumers, though, of course, if the work for which steam is required has to be checked, and the front of the furnace is raised for the purpose, and the motion stopped, on resuming work they are stoked, and for the time become ordinary furnaces, and give off smoke like them.

All three are upon the same principle: a very small continuous supply of fuel at the front of the grate, the smoke always being made in small quantities, combines with the air that passes through the bars, and is burnt before it can escape. All three have the advantage that there is no opening of fire-doors, and therefore an avoidance of the rush of cold air, which must have an injurious effect by contracting the boiler plates, in addition to the loss of heat. The only comparison we have to give of smoke-consumers with old-fashioned furnaces, is that our smoke-consumers do as much work with small coal as the old furnaces did with large. We tried a smoke-consumer, firing and stoking as in common furnaces, and found the coal used to be 12 per cent. more than when the grate was used as a smoke-consumer. As I have been asked whether we have any interest in any of the above patents, I may mention that we have not, nor ever have had any; and that our only advantage from the brewers and others who have seen our furnaces and asked our opinion, is, that some of them have had the

grace to introduce our machinery oil into their works, which was as much to their advantage as ours.

I am, dear Sir,

Yours truly,

8 November, 1853.

GEO. F. WILSON.

FLAX, AND ITS PRODUCTS, IN IRELAND.

Contributed by William Charley, Seymour-hill, Belfast.

LETTER III.

In my last letter, I alluded to the decline of the great Linen Mart of Dublin, and endeavoured to show the cause. The following description, given in 1819, of the Belfast *White Linen-hall*, explains the reason of its being built, which will be found confirmatory of my views.

"It is a large hollow square, erected by subscription, on the site of the Castle Gardens, in the year 1783, with intent of removing the sales of white linen from Dublin Hall to the heart of the manufacture.

Commission goods received by the Factors in nine years, from 1810 to 1818:

Years.	Packages.	Years.	Packages.
1810 - - -	159	1815 - - -	636
1811 - - -	206	1816 - - -	374
1812 - - -	247	1817 - - -	626
1813 - - -	487	1818 - - -	1241
1814 - - -	561		

Total, 4,537 packages; average value, 65*l.* each.

The major part of those linens were exported to America and the West Indies." (*See Thomas Bradshaw's "Directory," 1819.*)

The same authority faithfully describes the Brown Linen-market of Lisburn (a town seven miles west of Belfast, beautifully situated on the river Lagan.) After detailing the settlement of Mr. Louis Crommelin, of St. Quentin, France, in the neighbourhood of Lisburn, with his companions in exile,* the compiler continues:

"The virtuous conduct and civilized manners of these good people, were of great advantage to this place; and their skill and industry set an example to those who were concerned in the same business as they were, which soon had the effect of raising the quality of their manufacture to a degree of excellence unknown till then; and the linens and cambrics made in the neighbourhood, and sold in Lisburn market, have, until this day, kept up their superior character."

At this time (1819), and for many years after, the entire trade in BROWN linens was done in the provincial towns; the weavers purchased the necessary yarn, wove the cloth at home, and brought the pieces from the looms to the nearest suitable market, where the goods were purchased by the merchants or their agents. These merchants generally were proprietors of bleach-works; their business was to make the linen white and ready for use, and bring it for sale, as before explained, to the White Linen-hall of Dublin, at least while the monopoly existed there; afterwards, when that market,

* The following inscription is to be seen on a monumental tablet in the graveyard of Lisburn Cathedral Church:

"Six feet opposite lies the body of LOUIS CROMMELIN, born at St. Quentin, in France, (only son of Louis Crommelin, Director of the Linen Manufacture, and Anne his wife,) who died, beloved of all, aged twenty eight years, on 1st July, 1711. Luge viator, et ut ille dum vita manebat, suspice cælum despicie mundum et respice finem."

"Also, MARY MADELAINE BERNIERE, wife of Capt. Berniere, only daughter of Louis Crommelin," &c. &c.
There appears to be no monument existing in memory of the senior Mons. Crommelin.

in the course of events, was superseded, these gentlemen were the enterprising shippers and traders, not only to England, but to the most distant foreign countries. This leading branch of the trade required such an amount of capital, that the parties engaged therein were men of considerable property and intelligence.

Forty-five years ago, bills of exchange and bank-notes were not so available for raising finances and making payments as at the present day; so the buyers used often to carry their bags of gold with them, as they rode from town to town, attending the markets and making their purchases, which were settled for in coin; to prevent any risk of robbery they often joined company and made parties for the road, and many a merry ride and pleasant evening these good-humoured opponents enjoyed together.

For the regulation of the Brown Linen-markets the Linen Board provided paid inspectors; their duty was to examine the linen brought for sale, and to certify to the quality being genuine and sound.

These inspectors were styled, "Seal-masters;" and on each piece, before admission to the *Hall* or market, the inspector of the district had to affix his seal, so if any buyer was deceived in quality he had a remedy against the "Seal-master;" to whom he returned the piece found *imperfect*, and the "Seal-master" had to allow compensation; in his turn, he of course had to recover from the weaver. This market system is now gradually wearing out; instead of the petty dealers who bought the handspun yarn in small quantities to make one or two pieces *per month*, we have large manufacturers, *each* buying perhaps weekly quantities of yarn from the spinners, equal to the supply of some of the old markets; and several manufacturers now are proprietors of extensive mills, and are applying steam-power looms to the production of cloth. The principal markets in the old-fashioned style still in existence are Ballymena, noted for light four-fourth linens; Lurgan, for lawns and diapers; Coleraine and Ballymena, for seven-eighths fine linens; and Maghuafelt, Moulmore, &c., for low seven-eighths linen. In Belfast *Brown-hall*, a few good four-fourths are sold; but Lisburn *Brown-market*, once so celebrated for lawns, &c., is now extinct, owing to the cambric trade being lately absorbed by the manufacture of *bordered* handkerchiefs; so that all the plain linens brought by masses for sale, are now taken to Lurgan. There are some other small markets, but their "course is almost run;" indeed, it must be confessed that the concentration of the entire trade into fewer and richer hands has tended greatly to reduce the cost, and consequently to extend the demand for the manufacture.

A considerable portion of the time of the Linen Board in Dublin was occupied in the superintendence and revision of these provincial markets. No doubt the extreme particularity always displayed by them caused the inspectors to be very attentive to their duties as "Seal-masters;" and thus contributed directly to insure the merchant a perfectly made style of fabric, instead of leaving him at the mercy of a number of poor and cunning artisans, whose dwellings, scattered over a wide expanse of country, would be almost inaccessible for the purpose of redress to the passing buyer. An account of the different orders and reprimands of the trustees to their officers would be of no service or interest in this paper, and I will therefore pass on to other subjects.

The principle and practice of "Bounties" appear strange to a merchant of the present day. The following extract shows to what extent this encouragement was applied. (*See Repo t 1816*):

" Premiums given last year		£	s.	d.
Manufacturing sail-cloth, canvass, duck, &c., from mill-spun yarn		11,229	18	4
Manufacturing thread lace		77	6	0
Imitating Bristol candlewick		53	15	0
Spinning fine yarn		163	15	6
Total Premiums		£11,524	14	10
" Grants :		£	s.	d.
Utensils to trustees		4,337	17	2
Utensils to public institutions		969	17	2
Branding flax-seed		276	9	3
Branding utensils		132	15	4
Total Grants		£5,716	18	11

During the infancy of the manufacture some stimulants were perhaps necessary to promote the production of goods, but the great tendency of all such adventitious aid is, to encourage fraud and trickery: that such did take place, and that decided steps were required to check the extension of the evil, there can be little doubt. On 3rd August, 1816, the Custom-house authorities wrote to the Trustees: "The Commissioners of His Majesty's Customs having had under consideration certain regulations, in order to prevent frauds in the export of Bounty linens, and at the same time to unite security to the revenue, with convenience to the merchant, I am directed to transmit to you herewith, for the information of the Trustees of the linen manufacture and their officers, a copy of the regulations which the Board have ordered to be carried into effect on this subject; and to submit to the Trustees, that a large room or warehouse be set apart at the Linen Hall, for the reception of all goods made up in private warehouses or public calenders, &c., to which they must be sent for examination."

I find that in 1820, a meeting of linen-manufacturers was held at *Aberdeen*, on this very subject of Bounties; the third resolution passed was, "That it is the decided conviction of this meeting, founded upon long practical experience, that the Bounty which has now for nearly seventy years been granted upon the Exportation of British and *Irish* Linens, is of the most vital importance to the preservation of that valuable branch of trade; and that without such Bounty, it would be quite impossible for the British and *Irish* manufacturers to compete in foreign markets with the linen fabrics of the Continent, where the price of the raw material, as well as labour, is at all times extremely low." The fourth resolution requested Parliament to have the Bounties on the exportation of linen rendered *perpetual*—"a measure in the opinion of the meeting *essentially requisite to the stability and permanency of the manufacturer!*" If any of the gentlemen who were present at this meeting be fortunate enough to be now alive, they will perceive that the linen trade is far more healthy in its tone at present, than it was in the weakly season of Bounties. It is a singular fact, that perhaps the most backward part of the *Irish* manufacture in 1853 is the very one that received most money for encouragement during the ten years previous to 1828—namely, sail-cloth and canvass. In these Scotland and England still carry off the palm, if one can judge from the specimens seen in the Great Exhibition of 1851; at any rate, Britain now appears to supply the great dock-yards and the principal markets with this class of flaxen fabric.

In opposition to the opinion of the *Aberdeen* merchants already given, which was cordially supported by many *Irish* gentlemen, I beg, in conclusion, to quote the judicious remarks of the celebrated Adam Smith: "The

effect of Bounties, like that of all such expedients of the mercantile system, can only be to force the trade of a country into a channel much less advantageous than that in which it would naturally run of its own account."

N.B.—Erratum in printing last letter, 14th line, for "empowering," read *improving*.)

TO CORRESPONDENTS.

The publication of Mr. Septimus Piesse's letter "On Chemistry and Perfumery," and Mr. T. W. Booker, M.P., "On Cider," are unavoidably deferred.

MEETINGS FOR THE ENSUING WEEK.

- MON.** Institute of Brit. Architects, 8.—Prof. Donaldson, "On the Buildings of Lille, and on a Collection of Drawings presented to Lille by the late Chevalier Wicars," with Illustrations.
Geographical, 84.
- TUES.** Pathological, 7.
Linnæan, 8.
Civil Engineers, 8.—Mr. A. Henderson, "Large Ocean Steamers; their scientific construction, capabilities for navigation, and commercial economy."
- WED.** Society of Arts, 8.—Chairman's Address, and Opening of Exhibition of Inventions.
- THURS.** Royal, 84.
- FRI.** Architectural Assoc., 8.
- SAT.** Medical, 8.

PATENT LAW AMENDMENT ACT, 1852.

THE LORD CHANCELLOR in granting an application, with reference to a patent, took occasion to observe, that he had received during the recess several applications for extension of the time for filing specifications, &c., under the recent Patent Act. It would be well for the public to know that such indulgence could only be granted in cases where there had been no neglect or default on the part of the applicant or his agent. There would, however, shortly be a meeting of the Patent Commissioners, when the question would be brought under their consideration.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

From Gazette, 4th November, 1853.

Dated 9th August, 1853.

1851. T. Y. Hall, Newcastle-upon-Tyne—Safety-lamps, and method applicable to smoke consumption.

Dated 10th August.

1861. A. Prince, 4, Trafalgar-square—Press for lithography, &c. (A communication.)

Dated 12th August.

1888. W. L. Tizard, Aldgate—Combination of materials for binding purposes, and machinery for same.

Dated 17th August.

1923. F. A. V. Delarbre, 9, Broad-street-buildings—Treating fibrous substances.

Dated 27th August.

1993. S. Taylor, 53, King-street, Manchester—Apparatus for generating carbonic acid gas.

Dated 8th September.

2065. R. Harrington, Witham, Essex—Umbrellas, &c.

Dated 9th September.

2072. J. Radford, Cheltenham—Clocks.

Dated 16th September.

2156. F. B. Newton, Manchester—Method of cutting, partially dispensing with seams.

Dated 4th October.

2262. W. Pearce, Haigh, Wigan—Excavating coal by machinery.

Dated 7th October.

2297. J. Onions, 3, Park-terrace, and S. Bromhead, Marlborough Estate, Peckham—Steam-engine boilers.

Dated 14th October.

2365. S. Bromhead, Peckham—Emigrant's house and hinges.

Dated 17th October.

2397. J. J. Haite and W. Leach, New Coventry-street—Pistons of valved musical instruments.

Dated 20th October.

2421. W. Russell, Birmingham—Manufacture of copper tubes.
2423. J. France, North Wharf-road, Paddington—Mortising-machine.
2425. G. Gourgas, Paris—Buffer traction or suspension springs.
2427. W. Melville, Burntisland, Fife—Drawing ships out of water. (A communication.)

Dated 21st October.

2429. J. H. Johnson, 47, Lincoln's-inn Fields—Apparatus for sustaining bodies in the water. (A communication.)
2430. J. H. Johnson, 47, Lincoln's-inn Fields—Treatment of gutta serena. (A communication.)
2431. C. Crop, Farnworth, Lancashire, and J. Crosby, Manchester—Weaving machinery.
2433. J. Warburton, Addingham, Yorkshire—Preparation of rape-seed oil. (A communication.)
2435. J. F. F. Challeton, Paris, and 16, Castle-street, Holborn—Carbonizing and distilling peat, &c.
2436. P. M. Fouque, L. R. Hébert, and V. E. D. le Marneur, Paris, and 16, Castle-street, Holborn—A fortune-rudder in bronze.
2437. S. Loyd, jun., Wednesbury—Turntables.
2438. J. Greenbank and S. Pilkington, Withnell, Lancashire—Spinning machinery, &c.
2439. H. Cook, Devonshire-terrace, and A. Cook, Upper Berkeley-street—Communication between guard and driver.

Dated 22nd October.

2441. H. Bentley, Salford—Steam-boilers and fixing same.
2442. J. Baily, 113, Mount-street, Grosvenor-square—Cure of roup and other diseases in fowls and poultry.
2444. T. Connell, Cork—Safety apparatus and signals on railways.
2445. T. Walker, Pimlico—Railway-break.
2446. H. Greenfield, Old Cavendish-street—Power from carbonic acid gas.
2447. J. H. Johnson, 47, Lincoln's-inn Fields—Mills for grinding. (A communication.)

Dated 24th October.

2448. H. Kraut, Zurich—Regulating temperature.
2449. T. Stainton, South Shields—Steering apparatus.
2450. J. D. Young, Westminster—Casting.
2451. C. Brewster, Dunmow—Printing-machines. (A communication.)
2453. A. Hett, Stoke Newington—Smoke prevention.

Dated 25th October.

2458. J. Fordred, Dover, and T. Boyle, Forest-gate, Essex—Daylight-reflectors.
2460. A. Curtis, Sarraat Mills, Herts, and B. Donkin, jun., Bermondsey—Machinery for cutting rags, &c.
2464. D. Bogue, Fleet-street—Producing printing surfaces. (A communication.)
2466. C. Goodyear, Avenue-road, St. John's-wood—Boots and shoes.

Dated 26th October.

2470. G. G. Woodward, Lesswells, Kidderminster—Carpets.
2472. G. H. Palmer, Sheffield—Air-furnaces for fusion of steel, &c.
2474. W. Penrose, Landore Silver Works, Swansea—Reduction of silver ores.
2476. P. B. O'Neill, 39, Rue Miromenil, Paris—Screw wrenches.
2478. U. Lane, North-street, Brighton—Measuring time.
2480. T. Dunn, Windsor-bridge Iron Works, Pendleton, and W. Gough, 21, Old Compton-street, Soho—Manufacture of veneers, and machinery for same.

WEEKLY LIST OF PATENTS SEALED.

Sealed 2nd November, 1853.

1057. Henry Constantine Jennings, of Great Tower-street—Improvements in the manufacture of soap.
1060. James Reeves, of Bridgewater-gardens, Barbican—Improved machinery for forging, stamping, crushing, or otherwise.
1062. Auguste Edouard Loradoux Bellford, of Castle-street—Improvements in the extraction and manufacture of sugar, and of saccharine matters. (A communication.)
1065. Auguste Edouard Loradoux Bellford, of Castle-street—Improvements in sawing-machines for slitting or re-sawing plank and other timber by means of circular saws. (A communication.)

Sealed 3rd November.

1071. Thomas Claridge, of Bilston—Improved machinery for cutting or shearing metals.
1074. George Frederic Goble, of Fish-street Hill—Improvements in locks.
1079. Thomas Chambers and John Chambers, of the Thorncliffe Iron Works, near Sheffield—Improvements in kitchen sinks.
1085. Edward Walmsley, of Heaton Norris—Improved modes of preventing accidents arising from an insufficient supply of water in steam-boilers.
1088. Jean Brando Gianetti, of Paris—Applying the ascensional force of balloons to various useful purposes.

1133. George England, of Hatcham Iron Works, New Cross—Improvements in screw-jacks.
1145. Gregory Kane, of Dublin—Construction of portable houses, or portions thereof, out of parts, which may be used for other purposes.
1152. Alexander Chaplin, of Glasgow—Improvements in apparatus for the transmission of æriform bodies.
1160. Richard Edmondson, of Blackburn—Improvements in the manufacture of covered corded textile fabrics, and in machinery to be used for that purpose.
1178. Charles Pooley, of Manchester—Improved mode of feeding machines for opening, cleaning, blowing, and scutching.
1186. Richard Archibald Brooman, of Fleet-street—Improvements in the manufacture of hats. (A communication.)
1194. Thomas Stephen Holt, of Manchester—Improvements in steam-engines, which improvements are also applicable to the machinery or apparatus connected to steam-boilers.
1203. John Drungoole Brady, of Cambridge-terrace—Improvements in knapsacks.
1228. John Barsham, of Kingston-upon-Thames—Improvements in drying bricks, peat, and other articles.
1229. John Barsham, of Kingston-upon-Thames—Improvements in charring peat and other vegetable substances, and in burning lime.
1230. Edward Thornhill Simpson, of Wakefield—Improvements in the manufacture of manure.
1233. John Oakey, of Blackfriars-road—Improvements in reducing emery, glass, and other like substances.
1237. Samuel Wright, of Church-street, Shoreditch—Making a gas, steam, air, or liquid safety-tap.
1247. Charles Cowper, of Kensington—Improvements in steam-boilers.
1259. Louis Gervais Dieudonné Buffet Delmas Ducayla, of Bourdeaux—Improved manufacture of artificial fuel. (A communication.)
1300. William Weatherley and William Jordan, of Chatham—Improvements in the stuffing-boxes of piston-rods.
1316. Caleb Hill, of Cheddar—Improvements in the construction of staves.
1324. John Henry Johnson, of Lincoln's-inn Fields—Improvements in removing the gummy or glutinous matter from textile and other materials. (A communication.)
1345. Maxwell Scott, of Birkenhead—Improvements in propelling.
1374. Joseph Gyde, of Tooley-street—Improvements in mills and apparatus for grinding and dressing corn and various substances.
1394. George Bazett Colvin Levenson, of St. Helen's-place—A new application, construction, and arrangement of springs for carriages and such-like purposes.
1420. Samuel Frankham, of Greenland-place, Judd-street—Improved construction of coupling-joint, applicable to pipes, vessels of capacity, and other like uses.
1473. Solomon Solomon, of Aldgate, and Samuel Mills, of St. George's-in-the-East—Improvements in axle-boxes for locomotive engines, railway and other carriages, applicable to the bearings of machinery.
1666. Frederick Ransome, of Ipswich—Improvements in the manufacture of artificial stone and similar wares.
1693. Charles Goodyear, of St. John's-wood—Improvements in the manufacture of pens, pencils, and instruments used when writing, marking, and drawing.
1694. Charles Goodyear, of St. John's-wood—Improvements in preparing India-rubber.
1695. Charles Goodyear, of St. John's-wood—Improvements in the manufacture of beds, seats, and other hollow flexible articles to contain air.
1818. James Billings, of Greenwich—Improvements in roofing buildings.
1829. William Smith and Thomas Phillips, of Snow-hill—Improved boiler.
1852. William Rowan, of Belfast—Improvements in looms for weaving, and apparatus connected therewith.
1855. William Baines, of Coverdale-terrace, near Birmingham—Improvements in railways.
1872. Henry Moore Naylor, of Montpelier-row, Birmingham—Improvements in affixing postage and other stamps.
1876. William Longmaid, of Beaumont-square, Mile End—Improvements in the manufacture of manure.
1921. John Heritage, of Warwick—Improvement in the manufacture of bricks, pipes, tiles, coping, and such other articles as are or may be moulded in clay.
1943. George Heyes, of Bolton—Improvements in looms.
1952. John Steven, of Edinburgh—Improved axle-box for railway carriages and wagons.
1958. Moses Poole, of Avenue-road, Regent's-park—Improvements in crushing and pulverizing quartz and other substances. (A communication.)
1960. Thomas Charles Medwin, of Blackfriars-road—Improvements in steam-engine boilers.
1974. Edward Heard, of Regent-street, Lambeth—Mixture or composition of chemical agents for rendering sea-water fit for washing, and for softening hard water for other similar purposes.
1976. Alfred Beck Tompson, of Richmond—Improved spring door-hinge. (A communication.)
1988. Charles William Lancaster, of New Bond-street—Method of, and machinery for, manufacturing or producing certain descriptions of gun and pistol-barrels.
1994. Alfred Vincent Newton, of Chancery-lane—Improved construction of steam-hammer. (A communication.)
1998. John Foss, of Aldgate—Improvements in printing apparatus.
2008. Charles Goodyear, of Avenue-road, St. John's-wood—Improvements in rules, graduated scales, and measuring instruments.
2009. Charles Goodyear, of Avenue-road, St. John's-wood—Improvements in the manufacture and ornamenting or coating of articles, when compounds containing India-rubber are used.
2012. Alfred Vincent Newton, of Chancery-lane—Improved process of dyeing, part of which process is also applicable to bleaching. (A communication.)
2114. William Edward Newton, of Chancery-lane—Improved machinery for cleaning grain and seeds. (A communication.)
2020. William Edward Newton, of Chancery-lane—Improved machinery for reaping and gathering corn, grain, and other agricultural produce. (A communication.)
2046. William Edward Newton, of Chancery-lane—Improvements in breech-loading guns. (A communication.)
2060. Western Grimshaw, of Morsley, Ireland, and Ellis Rowland, of the same place—Improvements in the manufacture of bricks.
2082. Jonathan Amory, of Boston, United States of America—Improvements in furnaces.

Sealed 5th November.

1106. Matthias Edward Boura, of Crayford—Improvements in saddlery and harness.
1110. Thomas Fearnley, of Bradford, Yorkshire—Improvements in steam-boilers.
1116. John Ryan Danks and Bernard Peard Walker, both of Wolverhampton—Improvements in machinery or apparatus for the manufacture of nails.
1118. John Thomas Stroud, of Birmingham—Improvements in the valves of pressure-lamps, and in lamp-burners.
1120. Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury—Improvements in the manufacture of hat-plush. (A communication.)
1123. Mariano Riers, of Madrid—Improvements in fire-arms.
1124. Francesco Capeccioni, of Castle-street—Improvements in the manufacture of candles.
1126. Christopher Richard Norris Palmer, of Amwell—Improved mode of communicating or signalling between the guard and engine-drivers on a railway train; also applicable to other purposes.
2151. Francis Higginson, of King William-street—Improvements in the means of setting in motion and propelling ships, vessels, and boats of every description, upon seas, rivers, canals, and inland waters.

Sealed 7th November.

1129. Hesketh Hughes and William Thomas Denham, both of Cottage-place, City-road—Improvements in machinery for weaving.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Title.	Proprietor's Name.	Address.
Nov. 8	3528	The Reticulated Collar-case.....	Charles Gammon.....	2, Bloomsbury-square. Birmingham.
„ 9	3529	Billiard Bagatelle Table	Samuel Twist and William Morris.	